

## SEQUENCE LISTING

<110> HEGEMANN, Peter

<120> USE OF BIOLOGICAL PHOTORECEPTORS AS DIRECTLY LIGHT-CONTROLLED  
ION CHANNELS

<130> 231181

<160> 4

<170> PatentIn version 3.1

<210> 1

<211> 712

<212> PRT

<213> Chlamydomonas reinhardtii

<220>

<223> Amino acid sequence of CHOP-1 from  
Chlamydomonas reinhardtii

<400> 1

Met Ser Arg Arg Pro Trp Leu Leu Ala Leu Ala Leu Val Ala Leu  
1 5 10 15

Ala Ala Gly Ser Ala Gly Ala Ser Thr Gly Ser Asp Ala Thr Val Pro  
20 25 30

Val Ala Thr Gln Asp Gly Pro Asp Tyr Val Phe His Arg Ala His Glu  
35 40 45

Arg Met Leu Phe Gln Thr Ser Tyr Thr Leu Glu Asn Asn Gly Ser Val  
50 55 60

Ile Cys Ile Pro Asn Asn Gly Gln Cys Phe Cys Leu Ala Trp Leu Lys  
65 70 75 80

Ser Asn Gly Thr Asn Ala Glu Lys Leu Ala Ala Asn Ile Leu Gln Trp  
85 90 95

Ile Thr Phe Ala Leu Ser Ala Leu Cys Leu Met Phe Tyr Gly Tyr Gln  
100 105 110

Thr Trp Lys Ser Thr Cys Gly Trp Glu Glu Ile Tyr Val Ala Thr Ile  
115 120 125

Glu Met Ile Lys Phe Ile Ile Glu Tyr Phe His Glu Phe Asp Glu Pro  
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## 231181.ST25.txt

130	135	140
Ala Val Ile Tyr Ser Ser Asn Gly Asn Lys Thr Val Trp Leu Arg Tyr		
145	150	155
Ala Glu Trp Leu Leu Thr Cys Pro Val Ile Leu Ile His Leu Ser Asn		
165	170	175
Leu Thr Gly Leu Ala Asn Asp Tyr Asn Lys Arg Thr Met Gly Leu Leu		
180	185	190
Val Ser Asp Ile Gly Thr Ile Val Trp Gly Thr Thr Ala Ala Leu Ser		
195	200	205
Lys Gly Tyr Val Arg Val Ile Phe Phe Leu Met Gly Leu Cys Tyr Gly		
210	215	220
Ile Tyr Thr Phe Phe Asn Ala Ala Lys Val Tyr Ile Glu Ala Tyr His		
225	230	235
240		
Thr Val Pro Lys Gly Ile Cys Arg Asp Leu Val Arg Tyr Leu Ala Trp		
245	250	255
Leu Tyr Phe Cys Ser Trp Ala Met Phe Pro Val Leu Phe Leu Leu Gly		
260	265	270
Pro Glu Gly Phe Gly His Ile Asn Gln Phe Asn Ser Ala Ile Ala His		
275	280	285
Ala Ile Leu Asp Leu Ala Ser Lys Asn Ala Trp Ser Met Met Gly His		
290	295	300
Phe Leu Arg Val Lys Ile His His Ile Leu Leu Tyr Gly Asp Ile		
305	310	315
320		
Arg Lys Lys Gln Lys Val Asn Val Ala Gly Gln Glu Met Glu Val Glu		
325	330	335
Thr Met Val His Glu Glu Asp Asp Glu Thr Gln Lys Val Pro Thr Ala		
340	345	350
Lys Tyr Ala Asn Arg Asp Ser Phe Ile Ile Met Arg Asp Arg Leu Lys		
355	360	365
Glu Lys Gly Phe Glu Thr Arg Ala Ser Leu Asp Gly Asp Pro Asn Gly		
370	375	380
Asp Ala Glu Ala Asn Ala Ala Gly Gly Lys Pro Gly Met Glu Met		
385	390	395
400		
Gly Lys Met Thr Gly Met Gly Met Gly Ala Gly Met Gly Met		
405	410	415
Ala Thr Ile Asp Ser Gly Arg Val Ile Leu Ala Val Pro Asp Ile Ser		
420	425	430
Met Val Asp Phe Phe Arg Glu Gln Phe Ala Arg Leu Pro Val Pro Tyr		
435	440	445
Glu Leu Val Pro Ala Leu Gly Ala Glu Asn Thr Leu Gln Leu Val Gln		
450	455	460
Gln Ala Gln Ser Leu Gly Gly Cys Asp Phe Val Leu Met His Pro Glu		

## 231181.ST25.txt

465	470	475	480
Phe Leu Arg Asp Arg Ser Pro Thr Gly Leu Leu Pro Arg Leu Lys Met			
485 490 495			
Gly Gly Gln Arg Ala Ala Ala Phe Gly Trp Ala Ala Ile Gly Pro Met			
500 505 510			
Arg Asp Leu Ile Glu Gly Ser Gly Val Asp Gly Trp Leu Glu Gly Pro			
515 520 525			
Ser Phe Gly Ala Gly Ile Asn Gln Gln Ala Leu Val Ala Leu Ile Asn			
530 535 540			
Arg Met Gln Gln Ala Lys Lys Met Gly Met Met Gly Gly Met Gly Met			
545 550 555 560			
Gly Met Gly Gly Met Gly Met Gly Met Gly Met Gly Met Gly Met			
565 570 575			
Ala Pro Ser Met Asn Ala Gly Met Thr Gly Gly Met Gly Gly Ala Ser			
580 585 590			
Met Gly Gly Ala Val Met Gly Met Gly Met Gly Met Gln Pro Met Gln			
595 600 605			
Gln Ala Met Pro Ala Met Ser Pro Met Met Thr Gln Gln Pro Ser Met			
610 615 620			
Met Ser Gln Pro Ser Ala Met Ser Ala Gly Gly Ala Met Gln Ala Met			
625 630 635 640			
Gly Gly Val Met Pro Ser Pro Ala Pro Gly Gly Arg Val Gly Thr Asn			
645 650 655			
Pro Leu Phe Gly Ser Ala Pro Ser Pro Leu Ser Ser Gln Pro Gly Ile			
660 665 670			
Ser Pro Gly Met Ala Thr Pro Pro Ala Ala Thr Ala Ala Pro Ala Ala			
675 680 685			
Gly Gly Ser Glu Ala Glu Met Leu Gln Gln Leu Met Ser Glu Ile Asn			
690 695 700			
Arg Leu Lys Asn Glu Leu Gly Glu			
705 710			

&lt;210&gt; 2

&lt;211&gt; 737

&lt;212&gt; PRT

&lt;213&gt; chlamydomonas reinhardtii

&lt;220&gt;

<223> Amino acid sequence of CHOP-2 from  
chlamydomonas reinhardtii

&lt;400&gt; 2

231181.ST25.txt

Met Asp Tyr Gly Gly Ala Leu Ser Ala Val Gly Arg Glu Leu Leu Phe  
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Val Thr Asn Pro Val Val Asn Gly Ser Val Leu Val Pro Glu Asp  
20 25 30

Gln Cys Tyr Cys Ala Gly Trp Ile Glu Ser Arg Gly Thr Asn Gly Ala  
35 40 45

Gln Thr Ala Ser Asn Val Leu Gln Trp Leu Ala Ala Gly Phe Ser Ile  
50 55 60

Leu Leu Leu Met Phe Tyr Ala Tyr Gln Thr Trp Lys Ser Thr Cys Gly  
65 70 75 80

Trp Glu Glu Ile Tyr Val Cys Ala Ile Glu Met Val Lys Val Ile Leu  
85 90 95

Glu Phe Phe Phe Glu Phe Lys Asn Pro Ser Met Leu Tyr Leu Ala Thr  
100 105 110

Gly His Arg Val Gln Trp Leu Arg Tyr Ala Glu Trp Leu Leu Thr Cys  
115 120 125

Pro Val Ile Leu Ile His Leu Ser Asn Leu Thr Gly Leu Ser Asn Asp  
130 135 140

Tyr Ser Arg Arg Thr Met Gly Leu Leu Val Ser Asp Ile Gly Thr Ile  
145 150 155 160

Val Trp Gly Ala Thr Ser Ala Met Ala Thr Gly Tyr Val Lys Val Ile  
165 170 175

Phe Phe Cys Leu Gly Leu Cys Tyr Gly Ala Asn Thr Phe Phe His Ala  
180 185 190

Ala Lys Ala Tyr Ile Glu Gly Tyr His Thr Val Pro Lys Gly Arg Cys  
195 200 205

Arg Gln Val Val Thr Gly Met Ala Trp Leu Phe Phe Val Ser Trp Gly  
210 215 220

Met Phe Pro Ile Leu Phe Ile Leu Gly Pro Glu Gly Phe Gly Val Leu  
225 230 235 240

Ser Val Tyr Gly Ser Thr Val Gly His Thr Ile Ile Asp Leu Met Ser  
245 250 255

Lys Asn Cys Trp Gly Leu Leu Gly His Tyr Leu Arg Val Leu Ile His  
260 265 270

Glu His Ile Leu Ile His Gly Asp Ile Arg Lys Thr Thr Lys Leu Asn  
275 280 285

Ile Gly Gly Thr Glu Ile Glu Val Glu Thr Leu Val Glu Asp Glu Ala  
290 295 300

Glu Ala Gly Ala Val Asn Lys Gly Thr Gly Lys Tyr Ala Ser Arg Glu  
305 310 315 320

Ser Phe Leu Val Met Arg Asp Lys Met Lys Glu Lys Gly Ile Asp Val  
325 330 335

231181.ST25.txt

Arg Ala Ser Leu Asp Asn Ser Lys Glu Val Glu Gln Glu Gln Ala Ala  
340 345 350

Arg Ala Ala Met Met Met Asn Gly Asn Gly Met Gly Met Gly Met  
355 360 365

Gly Met Asn Gly Met Asn Gly Met Gly Gly Met Asn Gly Met Ala Gly  
370 375 380

Gly Ala Lys Pro Gly Leu Glu Leu Thr Pro Gln Leu Gln Pro Gly Arg  
385 390 395 400

Val Ile Leu Ala Val Pro Asp Ile Ser Met Val Asp Phe Phe Arg Glu  
405 410 415

Gln Phe Ala Gln Leu Ser Val Thr Tyr Glu Leu Val Pro Ala Leu Gly  
420 425 430

Ala Asp Asn Thr Leu Ala Leu Val Thr Gln Ala Gln Asn Leu Gly Gly  
435 440 445

Val Asp Phe Val Leu Ile His Pro Glu Phe Leu Arg Asp Arg Ser Ser  
450 455 460

Thr Ser Ile Leu Ser Arg Leu Arg Gly Ala Gly Gln Arg Val Ala Ala  
465 470 475 480

Phe Gly Trp Ala Gln Leu Gly Pro Met Arg Asp Leu Ile Glu Ser Ala  
485 490 495

Asn Leu Asp Gly Trp Leu Glu Gly Pro Ser Phe Gly Gln Gly Ile Leu  
500 505 510

Pro Ala His Ile Val Ala Leu Val Ala Lys Met Gln Gln Met Arg Lys  
515 520 525

Met Gln Gln Met Gln Gln Ile Gly Met Met Thr Gly Gly Met Asn Gly  
530 535 540

Met Gly Gly Gly Met Gly Gly Met Asn Gly Met Gly Gly Gly Asn  
545 550 555 560

Gly Met Asn Asn Met Gly Asn Gly Met Gly Gly Gly Met Gly Asn Gly  
565 570 575

Met Gly Gly Asn Gly Met Asn Gly Met Gly Gly Gly Asn Gly Met Asn  
580 585 590

Asn Met Gly Gly Asn Gly Met Ala Gly Asn Gly Met Gly Gly Met  
595 600 605

Gly Gly Asn Gly Met Gly Gly Ser Met Asn Gly Met Ser Ser Gly Val  
610 615 620

Val Ala Asn Val Thr Pro Ser Ala Ala Gly Gly Met Gly Gly Met Met  
625 630 635 640

Asn Gly Gly Met Ala Ala Pro Gln Ser Pro Gly Met Asn Gly Gly Arg  
645 650 655

Leu Gly Thr Asn Pro Leu Phe Asn Ala Ala Pro Ser Pro Leu Ser Ser  
660 665 670

231181.ST25.txt

Gln Leu Gly Ala Glu Ala Gly Met Gly Ser Met Gly Gly Met Gly Gly  
675 680 685

Met Ser Gly Met Gly Gly Met Gly Gly Met Gly Gly Met Gly Gly Ala  
690 695 700

Gly Ala Ala Thr Thr Gln Ala Ala Gly Gly Asn Ala Glu Ala Glu Met  
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Leu Gln Asn Leu Met Asn Glu Ile Asn Arg Leu Lys Arg Glu Leu Gly  
725 730 735

Glu

<210> 3

<211> 259

<212> PRT

<213> Halobacterium salinarum

<220>

<223> Amino acid sequence of bacteriorhodopsin from  
Halobacterium salinarum

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Met Leu Pro Thr Ala Val Glu Gly Val Ser Gln Ala Gln Ile Thr Gly  
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Arg Pro Glu Trp Ile Trp Leu Ala Leu Gly Thr Ala Leu Met Gly Leu  
20 25 30

Gly Thr Leu Tyr Phe Leu Val Lys Gly Met Gly Val Ser Asp Pro Asp  
35 40 45

Ala Lys Lys Phe Tyr Ala Ile Thr Thr Leu Val Pro Ala Ile Ala Phe  
50 55 60

Thr Met Tyr Leu Ser Met Leu Leu Gly Tyr Gly Leu Thr Met Val Pro  
65 70 75 80

Phe Gly Gly Glu Gln Asn Pro Ile Tyr Trp Ala Arg Tyr Ala Asp Trp  
85 90 95

Leu Phe Thr Thr Pro Leu Leu Leu Leu Asp Leu Ala Leu Leu Val Asp  
100 105 110

Ala Asp Gln Gly Thr Ile Leu Ala Leu Val Gly Ala Asp Gly Ile Met  
115 120 125

Ile Gly Thr Gly Leu Val Gly Ala Leu Thr Lys Val Tyr Ser Tyr Arg  
130 135 140

Phe Val Trp Trp Ala Ile Ser Thr Ala Ala Met Leu Tyr Ile Leu Tyr  
145 150 155 160

Val Leu Phe Phe Gly Phe Thr Ser Lys Ala Glu Ser Met Arg Pro Glu  
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231181.ST25.txt  
165 170 175  
Val Ala Ser Thr Phe Lys Val Leu Arg Asn Val Thr Val Val Leu Trp  
180 185 190  
Ser Ala Tyr Pro Val Val Trp Leu Ile Gly Ser Glu Gly Ala Gly Ile  
195 200 205  
Val Pro Leu Asn Ile Glu Thr Leu Leu Phe Met Val Leu Asp Val Ser  
210 215 220  
Ala Lys Val Gly Phe Gly Leu Ile Leu Leu Arg Ser Arg Ala Ile Phe  
225 230 235 240  
Gly Glu Ala Glu Ala Pro Glu Pro Ser Ala Gly Asp Gly Ala Ala Ala  
245 250 255  
Thr Ser Asp

<210> 4  
<211> 315  
<212> PRT  
<213> Chlamydomonas reinhardtii

<220>  
<223> Amino acid sequence of the CHOP2-315/H134R mutant  
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Val Thr Asn Pro Val Val Val Asn Gly Ser Val Leu Val Pro Glu Asp  
20 25 30  
Gln Cys Tyr Cys Ala Gly Trp Ile Glu Ser Arg Gly Thr Asn Gly Ala  
35 40 45  
Gln Thr Ala Ser Asn Val Leu Gln Trp Leu Ala Ala Gly Phe Ser Ile  
50 55 60  
Leu Leu Leu Met Phe Tyr Ala Tyr Gln Thr Trp Lys Ser Thr Cys Gly  
65 70 75 80  
Trp Glu Glu Ile Tyr Val Cys Ala Ile Glu Met Val Lys Val Ile Leu  
85 90 95  
Glu Phe Phe Phe Glu Phe Lys Asn Pro Ser Met Leu Tyr Leu Ala Thr  
100 105 110  
Gly His Arg Val Gln Trp Leu Arg Tyr Ala Glu Trp Leu Leu Thr Cys

## 231181.ST25.txt

115

120

125

Pro Val Ile Leu Ile Arg Leu Ser Asn Leu Thr Gly Leu Ser Asn Asp  
130 135 140

Tyr Ser Arg Arg Thr Met Gly Leu Leu Val Ser Asp Ile Gly Thr Ile  
145 150 155 160

Val Trp Gly Ala Thr Ser Ala Met Ala Thr Gly Tyr Val Lys Val Ile  
165 170 175

Phe Phe Cys Leu Gly Leu Cys Tyr Gly Ala Asn Thr Phe Phe His Ala  
180 185 190

Ala Lys Ala Tyr Ile Glu Gly Tyr His Thr Val Pro Lys Gly Arg Cys  
195 200 205

Arg Gln Val Val Thr Gly Met Ala Trp Leu Phe Phe Val Ser Trp Gly  
210 215 220

Met Phe Pro Ile Leu Phe Ile Leu Gly Pro Glu Gly Phe Gly Val Leu  
225 230 235 240

Ser Val Tyr Gly Ser Thr Val Gly His Thr Ile Ile Asp Leu Met Ser  
245 250 255

Lys Asn Cys Trp Gly Leu Leu Gly His Tyr Leu Arg Val Leu Ile His  
260 265 270

Glu His Ile Leu Ile His Gly Asp Ile Arg Lys Thr Thr Lys Leu Asn  
275 280 285

Ile Gly Gly Thr Glu Ile Glu Val Glu Thr Leu Val Glu Asp Glu Ala  
290 295 300

Glu Ala Gly Ala Val Asn Lys Gly Thr Gly Lys  
305 310 315